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The Invisible Work of Distributed Medical Education

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Title: The Invisible Work of Distributed Medical Education: Exploring the Contributions of Audiovisual Professionals, Administrative Professionals and Faculty Teachers

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Abstract

Distributed medical education (DME) is becoming increasingly prevalent. Much of the published literature on DME has focused on the experiences of learners in distributed programs; however, our empirical work leads us to believe that DME changes the context significantly, not only for learners, but also for other important members of the educational community including: audiovisual professionals, administrative professionals and faculty teachers. Based on a three-year ethnographic study, we provide a detailed account of how alliances between various workers involved in DME develop to produce and deliver an undergraduate medical curriculum across geographically separate campuses. We explore the question 'What is the work involved in the delivery of a DME program?' and cast a critical gaze on the essential but invisible, and therefore unrecognized and underappreciated, contributions of AV professionals, administrative professionals, and faculty teachers. Our goal is to make visible the complexity of DME, including the essential contributions of these workers. The study was theoretically framed in sociomateriality and conceptually framed in Star and Strauss' notion of articulation work.

Key Words

administrative professionals; articulation work; audiovisual professionals; distributed medical education; ethnography; faculty teachers; sociomaterial

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Introduction

Distributed programs are changing the face of modern medical education. The skills and expertise required to deliver a distributed medical education (DME) program are different than those required in a traditional program. In this paper we explore the work associated with designing and delivering a DME program in order to shed light on some of the less recognized aspects. In making the work associated with DME visible, our hope is that we will not only shed light on the sociomaterial complexities of DME, but also help to make this work more valued.

While there are a variety of ways to define distributed learning, we use the term to refer to the distribution of curriculum to satellite campuses, which are often in rural settings, using videoconferencing (sometimes referred to as telepresence) or other technological mechanisms of connection. Distributed learning is growing as an approach to distance learning (Gray et al., 2014; Kondro, 2006; Snadden et al., 2011; Stewart et al., 2011). Distance learning includes four commonly agreed-on components. Firstly, it is institutionally based (that is, one institution is the ‘owner’ as well as ‘provider’ of the curriculum); secondly, it is characterized by a separation between the teacher and the student – a separation that might be geographic or temporal; thirdly it uses either synchronous and/or asynchronous telecommunications; and fourthly, it relies on the sharing of resources (Simonson,

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Smaldino, Albright and Zvacek, 2012; Toomey, Lovato, Hanlon, Poole and Bates, 2013).

Generally speaking, distributed medical education (DME) falls within the parameters of distance learning. Ranging in complexity from simple web-conferenced delivery of individual learning opportunities to fully distributed education programs, the advent of distributed medical education (DME) has added another layer of complexity to the practice of medical education. Consistent with this delivery method is an integration of highly technologized learning spaces and teaching approaches. Rather than curriculum delivery taking place in a face-to-face context, instruction in these programs is often technologically mediated, meaning it is delivered through video or web-conferencing to a variety of locations and is reliant upon cameras, screens, microphones, and Internet. Certainly, the integration of these technologies has changed the work that has traditionally constituted health professions education.

No longer a traditional teacher-student interaction, distributed approaches challenge taken for granted notions of what constitutes education work, and are reliant upon resources, technological tools and people. Based on data from our sociomaterial ethnographic study at a Canadian medical school, and using Star & Strauss's ecology of visible and invisible work (1999) as a conceptual framework, we explore the visible and invisible work involved in delivering a DME program

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with a focus on the often unrecognized contributions of the workers who make DME happen.

While much research in the broader field of distance learning and distributed approaches has focused on the experiences of learners, our empirical work leads us to believe that DME changes the context significantly, not only for learners, but also for other important members of the educational environment. In this paper, we therefore shift the focus away from the experiences of learners to explore the social and material realities of those who are formally working in a DME context in the undergraduate program at one Canadian medical school (Dalhousie University). We specifically focus on the work of audiovisual (AV) professionals, administrative professionals and faculty teachers, the pedagogical partners who are central to the design and delivery of DME.

The paper explores the following questions: What is the work—both visible and invisible—involved in the delivery of a DME program? How do people and things (curriculum, technology) participate together to produce DME? How do DME technologies change established forms of medical education work? And what are the changing human and nonhuman assemblages that have been co-produced in a distributed medical education context? Based on three-years of ethnographic data, we provide a detailed account of how new alliances between various actors involved in medical education have developed—technologies and other materials, faculty, audiovisual and administrative staff—producing and distributing an undergraduate

medical curriculum across geographically separate campuses. This paper builds on our previous work (MacLeod et al, 2015) where we argued that a sociomaterial framework helps to destabilize some of the taken for granted assumptions about how everyday medical education is accomplished.

Methodology

We conducted an ethnographic study framed informed by sociomateriality (James & Rusher, 2013; Landri, 2013; Mazmanian et al., 2014; Tummons, MacLeod & Kits, 2015). We focused on the distributed undergraduate medical education program at Dalhousie University. Our work included a variety of data collection strategies, including observations, interviews and document analysis, in order to build a detailed description. Rather than focusing on specific curricular elements, the focus of our data collection was the educational technology itself (the telepresence videoconferencing system) and how people interacted with it, worked with or around it, and responded to it. We therefore focused on events that were 'videoconferenced' which included mainly large group lectures, but also laboratory sessions, and meetings.

In order to critically investigate the practices of distributed medical education (DME), our ethnographic explorations took into account both social *and* material

factors. Human processes—social, cultural and personal—are certainly important ethnographic considerations; however, they are also intricately interwoven with the materials (things) constituting everyday DME. Therefore, we explored the reciprocally constitutive (Orlikowski, 2007) involvement of people and things: in our case, the people and technologies that allow distributed learning.

We gathered data over three years, immersing ourselves in the setting of one medical school from 2012-2015, learning about the program, and gathering formal and informal data. This longitudinal approach allowed us to gather a variety of data in order to build a progressive, in-depth analysis. In addition to our field notes and memos, the formal data included a critical textual analysis of a set of institutional documents and policies (n=65) (Hodder, 2000; Rapley, 2007), observations of distributed learning activities on two distributed campuses (n = 108 hours) (Angrosino, 2007; Angrosino & de Pérez, 2000), and in-depth interviews with faculty, students, and audiovisual professionals (n = 33) (Kvale, 2007).

Our analytical approach involved an iterative process in which ideas that arose during active involvement “in the field” were translated and represented in a written account. This involved categorizing our various sources of data to detect and interpret themes, looking for inconsistencies and contradictions, and developing ideas about what was happening and why. We considered the complex interaction of human (people) and non-human (things) actors in producing the work of DME. Our analyses focused on the social and cultural relations taking place in multiple

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locations, and also on tracing the ways in which the material, including location-specific classroom spaces and community resources, structures the work of DME and makes people do things differently or similarly at each site.

Data were analyzed in accordance with Wolcott's (1994) three-step approach to the analysis of ethnographic data: description; analysis; and interpretation. We reviewed each data source in order to develop a coding framework. The framework was then applied as the data were independently coded, thematized and analyzed first by method (text, observation, interview) as an individual, site-specific data set, and then for the project as a whole. A core team of researchers took primary responsibility for the analysis and interpretation of data, however the larger team was involved in data interpretation. We used qualitative data analysis software (ATLAS.ti) to assist with the sharing and management of data (Odena, 2013; Tummons, 2014). This iterative method of analysis allowed us to investigate the connections between what people say and what people do while paying particular attention to the effects of materiality on DME.

This research was conducted in accordance with the Tri-Council Policy Statement on Research Ethics was reviewed by the Dalhousie University Social Science and Humanities Research Ethics Board.

The Research Site

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This research was conducted at Dalhousie University, which has a distributed undergraduate medical education program. One group of students is located in Halifax, Canada on the campus of Dalhousie University. Approximately 80 students per year are admitted to this campus. The second, and newer, distributed site began delivering curriculum in September 2010 and is located in Saint John, Canada. Approximately 30 students per year are admitted to this campus. During the first two years of study (pre-clerkship) students study exclusively at their home site, but they are connected via state of the art videoconferencing for large group sessions, like lectures. Other components, such as small group learning and laboratories are delivered separately; however, accreditation standards require that these offerings are delivered in a manner that is “comparable.” As the program’s website indicates, “It’s one MD class, using the exact same curriculum, and all students graduate with a medical degree from Dalhousie University ” (REF). While the undergraduate curriculum is governed by one office of undergraduate medical education, located in Halifax; however, each campus has a team of administrative and information technology professionals working to ensure the effective delivery of the program across two sites.

Conceptual Framework

Distributed medical education (DME) increases the technological complexity of educational delivery. Rather than the traditional act of a professor interacting

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directly with the students who are physically present in the same space, learners are located at different geographical locations and this is facilitated through a network of technologies.

In order to connect the learners at the various sites, a variety of human and nonhuman actors must be involved. Given the fact that many programs currently offer some sort of distributed delivery—whether through fully integrated telepresence systems, as is the case in many Canadian and American programs, to less technologically-oriented, smaller scale systems like web-conferencing modules—the assemblage of people and technologies required to produce distributed education is significant. This is particularly pronounced in a telepresence environment. Yet, many of the people who are involved, and much of their work, escapes formal classification with respect to what has traditionally comprised medical education. Despite the fact that this work is essential to the actual delivery of the program, it remains largely invisible. Star & Strauss (1999) remind us that recognizing work that escapes formal requirements is important in understanding the actual level of effort required to accomplish a task (in our case, the delivery of DME) and also in representing the subtleties of cooperation between the various workers involved.

Distributed medical education is a sociomaterial practice, and as such there is a spectrum of visible and invisible work involved. Much of this work falls under Star & Strauss's definition of "articulation work" which is "work that gets things back 'on

track' in the face of the unexpected, and modifies action to accommodate unanticipated contingencies. The important thing about articulation work is that it is invisible to rationalized models of work" (1999, p. 10). Articulation work, then, constitutes a workaround and occurs when workers strategize to overcome breakdowns, oversights, miscommunications and other such social and material challenges.

Articulation work; however, does not take place in a vacuum. As Orlikowski noted "everyday organizing is inextricably bound up with materiality" (2007, p. 1435). Medical school learning, teaching and administrating has always been enmeshed with material actors of all kinds, whether they are buildings, virtual or material spaces, desks, chalk boards, pencils, books, smart phones, human and nonhuman bodies, lab equipment, and so on. Materials, then, are foundational in producing our everyday worlds, including DME.

Interestingly, the medical education literature has shied away from recognizing that a human-centred approach to understanding the intricate process of medical education produces an oversight with respect to most things material (Fenwick & Nimmo, 2015; MacLeod et al., 2015). Medical education is deeply humanistic in its underlying assumptions and theories. This is not surprising, as medical education exists to support the development of medical students into caring and competent physicians (MacLeod, 2011). The expectation is that graduates will be working with and on humans and their bodies. However, by adopting a multi-dimensional

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sociomaterial understanding of the work that is actually involved in developing, performing and distributing medical education across multiple sites, we can provide an enriched description and analysis of the process of teaching, learning and administrating.

Distance Learning and Distributed Medical Education (DME)

Distance learning has been described as a means of increasing access to education (Hurst et al., 2013; Matsura, 2005) and also as a means of addressing critical shortages of professionals in rural areas, the idea being that those who are educated in rural settings are more likely to stay and work in those settings (Strasser et al., 2009). Because of this potential, distance learning has been described as “a powerful and transformative means to meet these learning needs, as well as to extend and enrich traditional modes of instruction, at the post-secondary level” (ACOL, 2002, p. ix).

Distance learning has been the focus of much research. For example, a significant literature explores learning outcomes in distance settings (Anglin & Morrison, 2000; Berge & Mrozowski, 2001; Phipps & Merisotis, 1999; Ronsisvalle & Watkins, 2005; Simonson, 2002). Other well-defined bodies of literature describe learners’ perceptions and/or experiences of distance learning (Eneau & Develotte, 2012; Koohang & Durante, 2003; Lim, Morris & Kupritz, 2014); learner attributes (Carabajal, LaPointe & Gunawardena, 2007); learner interaction (Garrison et al,

2001; Moore, 1989; Rourke et al., 2001); learner barriers (Muilenburg & Berge, 2000); and various technologies (Park, 2011; Lockwood & Gooley, 2012). Despite a large literature base and Holmberg's (1985) landmark call for rigorous and theoretically based interrogations, distance learning has been proportionately overlooked by critical social science investigations in the broader field of education and is almost completely absent from the discipline of medical education.

Our ethnographic research focused on one approach to distance learning: distributed medical education. Much of the published literature on DME has explored the experiences of learners and/or communities in distributed programs (Bates et al., 2013; Mihalynuk et al., 2008a; Mihalynuk et al., 2008b). Some of the literature has also considered the technologies that facilitate DME. These range from relatively inexpensive desktop or web-based conferencing to very expensive videoconferencing, or "telepresence," facilities designed to simulate the experience of being in the same space together using cameras, microphones and screens (Lawson et al., 2010). Telepresence is becoming increasingly common in distributed medical education (Snadden & Bates, 2005) and was the focus of our research. One of the benefits of telepresence is that it allows for immediate interaction between those in various locations (Offir & Lev, 1999), facilitating a "social presence" which is an important consideration in any distance learning approach (Cleveland-Innes & Campbell, 2012; Cleveland-Innes & Garisson, 2011; Rourke et al., 2001; Stewart et al., 2011). However, a significant investment in the form of technologies, fast Internet connections, state of the art hardware (Smyth, 2005), and highly-trained

audiovisual technicians (MacLeod et al., 2015) is required to facilitate telepresence-based delivery.

The distributed medical education literature focuses on the issues involved in establishing and/or maintaining a distributed program from the perspective of senior leadership (Snadden & Bates, 2005; Strasser et al., 2009); experiences of learners (Cleveland-Innes & Gauvreau, 2011; Garrison, Cleveland-Innes, Fung, 2010; Rourke et al., 2001; Stewart et al., 2012); and the advantages and disadvantages of the technologies themselves (Park, 2011; Belanger & Jordan, 1999). Missing from this literature is a consideration of the multi-dimensional work involved in the successful delivery of a distributed program. Our research has addressed this gap.

Results

We discuss herein the articulation work involved in the delivery of distributed medical education (DME) based upon three years of ethnographic study. Our goal is to make visible the hidden skill sets, tools, initiatives, and expertise that are involved from the perspectives of three groups of workers – AV professionals, administrative professionals and faculty teachers. Certainly, articulation work is not unique to DME. In any given practice, a continuum of work is required, some of which is more visible and valued than others. However, given the relative newness

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of the DME, its reliance on technologies, and its increasing popularity, we believe it is an ideal time to shine a light on these lesser-recognized contributions.

Documenting and exploring visible and invisible work allowed us to move the conversation away from taken for granted ideas regarding DME to think more critically about the sociomaterial intricacies of distributed approaches. A word about ‘invisible work’ before we describe our results: work may become mundane, predictable, part of the background or invisible by virtue of being routine. Certainly, if one looked, one could actually see the work being done – but the taken for granted status makes this work functionally invisible (Star & Strauss, 1999).

We identify some of these unrecognized aspects and describe them here in an effort to draw attention to the sociomaterial complexity of the work of DME. In order to lend consistency to our description, we describe each type of worker (AV professional, administrative professional, and faculty teachers) in terms of their relationship to 1) curriculum; 2) other members (people) of the DME environment; and, 3) the technologies of DME.

Audiovisual Professionals

The distribution of curriculum to various geographical locations requires the integration of specific technologies that include cameras, screens, microphones, and Internet connections. DME is therefore dependent upon a group of workers with related technological expertise.

In the context of our research, the people filling these roles make the distinction between IT (information technology) and AV (audiovisual) professionals. While it has become part of the everyday operations for institutions of medical education to work with information technologists, AV professionals extend that skill set, bringing a performance orientation to the work, focusing on optimizing tools and technologies for maximum production value. Some of these workers have backgrounds in music and event production, and this certainly translated in the ways they approach their work, with many describing a mindset of ‘the show must go on.’

Through our ethnographic work, we learned that AV professionals have a **relationship with curriculum**. Though not involved in its development, these professionals had a significant role in shaping the form and processes of the materials being delivered in order to optimize it for distance delivery. This involved the development of processes and policies designed to facilitate distributed delivery, including an early submission of lecture slides policy and the development of a PowerPoint template to standardize materials. These policies and tools were developed by AV professionals to ensure that the curriculum is seamlessly delivered at multiple locations. This discourse of seamlessness permeated our conversations with AV professionals, and the focus results in an extremely dependable delivery of curriculum.

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While the reliable delivery of curriculum generated through these efforts was well recognized by faculty and students, this work resulted in an interesting dynamic by which the work of the AV professionals responsible was largely invisible. Other people we interviewed, including faculty and students, spoke with praise about the dependability of 'the technology' as a ubiquitous entity, rather than recognizing the skilled professionals, and their tacit professional expertise, working behind the scenes to ensure a dependable experience of DME.

Despite the reliability of the technology being the most visible aspect of AV work for other members of the medical school, the AV professionals we observed and interviewed were less interested in the technology, and considered the human side of their work the most important aspect. One AV professional noted:

The technology is easy. I can take my 6-year-old son and teach him how to use the camera controls. But to be able to read whether or not making this change is going to interrupt a lecture in the middle of it, watching the people, seeing the audience, recognizing whether or not 'hey, that student is really trying to get the prof's attention and they're not getting anywhere'--I like that. I like being able to watch the people. I like the people side of it.

-AV Professional

This presents an interesting dynamic in terms of developing a **relationship with others**, including students, faculty and administrative professionals. The AV

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technologists, who monitor delivery of curriculum behind the scenes from a control room, described striving to be an “undetectable” monitor of the educational process, noting that if they are doing their job, they should be “imperceptible.” Yet, this invisibility separates them, to some degree, from the human aspects of the job, which made the establishment of relationships complicated.

I feel like I know them all and yet half the time, I don't know their names.

-AV Professional

I see [faculty member's name] all the time. And the first time I met her face-to-face, I felt like I should be able to have an 'old friends' conversation. And she didn't know who I was from Adam.

-AV Professional

Interestingly, despite a described lack of relationship with the other members of the DME environment, it is also the human aspects of DME that seemed to mediate AV professionals' **relationships with the technology**. AV professionals have the ability to manipulate the screens, cameras and microphones of the distributed learning classroom at any point and for a variety of reasons: to optimize performance, to address a glitch, to engage a group of students, etc. Yet, the decision to do so is one that is based on people considerations rather than technological ones. More often than not, the position of these professionals is to maintain the status quo rather than

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using their technological expertise, unless they are directly consulted or asked to make a change.

I've been sitting in the control room monitoring the classroom and seeing it going off the rails, and knowing full well there's not a darn thing I can do. This is going to go off the rails and I've got to wait.

-AV Professional

Deciding when and how to intervene when something seems to be going wrong is a critical aspect of the work of AV professionals, and can also be a source of stress and deliberation. AV professionals must go through a process of weighing multiple factors, not the least of which is related to the hierarchical nature of higher education. As one AV professional described:

You're a professor; I'm a technology support person. Do I really have the right to change your classroom environment?

-AV Professional

The articulation work involved with facilitating the distributed learning technologies seems to involve 'knowing your place' in the broader institution and focusing on producing a seamless educational experience all while remaining largely imperceptible. This reproduces the deeply embedded nature of technology work in the world of medical education and leads to the skills and expertise of these

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professionals, and to some degree, their very existence, being largely unrecognized, even conflated with the technology itself. As Star and Strauss noted, 'Deference behaviour soon gives way to the employer treating the person as a thing' (p. 17); harkening back to the important observation that members of a DME context can sometimes overlook the people involved in the work while being completely complimentary about 'the technology.'

Administrative Professionals

Administrative professionals (administrative assistants, curriculum coordinators, etc.) play a significant role in assuring that the teaching and learning needs of faculty and students at each location are taken into account in a comparable manner. Comparability is a dominant discourse (Gee, 1996) amongst this group, and is most likely based in the former Liaison Committee on Medical Education accreditation standard that reads "The curriculum of a medical education program must include comparable educational experiences and equivalent methods of assessment across all instructional sites within a given discipline" (Liaison Committee on Medical Education, 2013, p. 8).

Striving for "comparability" lead to an interesting mixture of visible and invisible work: the administrative professionals we interviewed discussed working on their own initiative to establish policies and procedures to enhance comparability which would eventually become critical components of the everyday operations of the

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DME program, and the larger administration of undergraduate medical education. Yet, the actual establishment of these policies happens behind the scenes.

Through our ethnographic fieldwork, we learned that administrative professionals in a DME context had a significant **relationship with curriculum**. At the location of our study, the delivery of curriculum through DME was a new endeavour, which meant that there was a lot to learn about how to deliver curriculum to multiple locations. The need for representation from the various distance sites in curriculum-related meetings, decisions and processes was relatively straightforward and recognized (i.e. including members of decision making committees, connecting rooms via telepresence, etc.), yet when it came to the everyday practice of DME (i.e. mundane things like copying relevant parties on emails, considering scheduling complications, etc.) there were often oversights which led to people not being informed of important practical details.

The administrative professionals recognized challenges, troubleshoot, and took the initiative to develop systems to mitigate and avoid these challenges in the future. Interestingly, this led to the establishment of 'grassroots' policies that eventually became normalized, accepted by the broader institution and shaped the processes by which distributed curriculum was conceptualized and delivered. These professionals described taking a degree of ownership related to the processes of DME and "getting it down to a science."

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So we decided that we would take the sole ownership of the curriculum regardless of campus. And so if I was scheduling something, I would do it for both campuses. And if she was creating a document, it was for both campuses. And we signed our emails to faculty and to students from both of us so that we were really a united front. If someone asked me a question, it would be the same as asking her.

-Administrative Professional

So it was scary... it was a very steep learning curve. And there were times I would take my job description out and I wonder what it is I'm exactly supposed to be doing. The good thing is I had a really great partner [at the distance site]. ... Really although it felt the scariest, it was the ideal situation because there wasn't a history of how things should run. We got to kind of develop that together.

-Administrative Professional

As demonstrated in the above quotations, these strategies were heavily reliant upon the development of strong **relationships with others** at the various sites. Without fail, administrative professionals described, working closely with a partner at a distant site and developing a strong trusting relationship with that person.

But you have to trust. You have to get to the point where you have to trust your co-workers because otherwise you're going to be doing the work double.

-Administrative Professional

In the context of our study, the building of relationships was described as essential to the delivery of DME, yet, it is very much invisible and, to a certain extent, emotional work. This leads to important questions with respect to what 'counts' as productive work, particularly in a university context where 'knowledge work' (Star and Strauss, 1999) as opposed to emotional work is highly valued.

Relationships with technology were a central consideration of the work of administrative professionals. In order to facilitate the critically important relationships with colleagues at other sites, administrative professionals made use of available tools, most noticeably webconferencing technologies, but also telephone, text messaging and email. Our participants describe being in "constant connection," stepping away only during break times. Troubleshooting related technological challenges becomes another invisible feature of their work, as described below.

So a co-worker recently had a situation where they were video-conferencing with another site who aren't used to the technology and they were whispering. But you could hear everything. She sent them an email and thankfully they read it – to say we can hear everything you say.

-Administrative professional

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While there may be an expectation that administrative professionals help to maintain the status quo with respect to the delivery of DME, the degree to which they are invested in this work is noteworthy. The largely invisible aspects of their work, which is heavily relationship-centred, serve to position these workers as what Star & Strauss (1999) might term a “non-person,” meaning that the product of their work is visible, but to a certain degree the person her or himself—including their initiatives with respect to developing strategies that help to shape the way we engage in DME—are largely invisible.

Teaching Faculty

The traditional role of a medical school teacher was to deliver content. For many faculty members, DME brings a change in their usual, historically and culturally situated ways of conducting their teaching activities. In today’s world the implementation of DME is made possible through technology, in some cases state-of-the-art technology. However, the need to distribute education to different sites in an equitable and comparable way requires systems, structures and processes to effectively support distribution. Relatedly, the actual work of being a medical teacher has also changed, and now involves a variety of essential, but somewhat invisible tasks, that differentiate this work from what it might have been historically, not unlike in the broader context of higher education (Blin & Munro, 2008; Breen et al., 2001; Kirkwood & Price, 2013; Unwin, 2007).

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The disciplinary content of medical education has traditionally been the province of the teacher. Historically, the teacher has had the right and responsibility to develop their courses in a way they believe will meet the objectives. They have developed their lectures, changed them as they felt necessary—the lecture was the teacher’s intellectual property. With increasing requirements from medical education accrediting bodies for a more centrally controlled curriculum, some guidance and direction have been provided to teachers with regard to the learning objectives to be addressed by their lectures; however, some autonomy was still retained by the teacher.

In the context of our research, the introduction of a fully distributed four-year program coincided with the implementation of a new curriculum, resulting in many new systems, processes and networks. A significant material investment in the form of state-of-the-art videoconferencing technology was installed to allow the curriculum to be distributed to multiple sites, without any delay. Accreditation standards require that students at both/all sites receive comparable experiences and have equal access to resources, both for their learning, as in library resources, and teachers, and for other activities and personal support.

In a distributed setting, medical teaching now requires a significant amount of largely invisible work. In order to adjust their teaching to this context medical teachers engaged in a form of articulation work with respect to their **relationship**

to the curriculum including making changes to content and format, timing of lesson preparation, ownership of or control over the use of content.

To ensure that that the AV professionals had time to check their PowerPoint presentations to ensure that they could be distributed identically to both sites, slides were required to be submitted two weeks before the planned lecture. Review by the AV professionals frequently resulted in a new template being applied to the teacher's slides, which physically altered the visual presentation of the content, requiring the presenter to review and revise them a second time.

In those instances when lecturers who did not submit their presentations in advance and teachers arrived with their materials on a USB stick, they were unable to use their presentation. In addition to the disruption and responses this engendered in the teacher, a properly-formatted lecture from a previous year might be substituted, leaving the teacher not only without his or her slides, but possibly with a lecture created by someone else. This was the source of considerable stress for some faculty teachers:

So the technology I thought was almost flawless, to be honest. I never had a single hiccup with the technology, except that if somebody shows up with a stick with their lecture on it, being able to upload it. And you know, there was always a kickback, saying, look, we warned you, you had to be in 2 weeks

before. But I'll tell you what, you can't...it's very hard to mandate it. And if the students suffer because of it then that's not acceptable for me.

-Faculty Teacher

Sometimes both content and the delivery format required restructuring. For example, because laboratory sessions sometimes could not be delivered identically, the decision was taken to convert the 'lab' session into an interactive lecture, which nevertheless was still labelled as a laboratory session. Lectures, even interactive lectures, offer very different learning opportunities than the more experiential, hands-on laboratory experience and necessarily lead to different learning outcomes.

To ensure that lectures could be viewed again and made available to learners they were recorded live. While a benefit to learners who can view them again to review the content, some teachers felt their ownership of intellectual content was breached; they also worried about whether students would attend class.

While these examples happened infrequently, and have lessened as users have become accustomed to the system, they represent the agency of both the human and material aspects of the curriculum and how they may interact. They also make clear the fact that teaching work in a DME environment involves a new set of skills, and perhaps, a new set of concerns or stresses.

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Faculty members also engaged in articulation work with respect to building **relationships with others**, most notably students. These changes included how they connected with learners, how they managed the classroom setting and how the learners played a role in supporting them as teachers.

Teachers unanimously appreciated the reliability of the technology. However, they also noted a related tension because their relationships with learners changed. The most persistent theme was that of 'losing the personal connection', both through the requirements of the technology and the fact that some students were not in the room with them.

To enable learners at distant sites to have equal access to the lecture and to ask questions etc., a system of microphones is used. Students must use the microphones to ask questions, which may be intimidating for some learners. Instead, students who are physically located at the same site as the lecturer frequently wait to ask their question at the end of the lecture. Not only does this mean that questions that might benefit the entire class are not shared; it also means that one to one contact with the teacher is possible in just one site. Teachers have developed a workaround system of inviting all learners to contact them by email; however, the efficacy of that solution is questionable.

I tried to emphasize that I'm always available. I put my email address up at the end of every lecture. . . And I was expecting a lot more emails but I don't think

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students really email as much anymore because I only got like a few here and there.

-Faculty Teacher

Teachers report that it is difficult to ‘read’ the learning environment’ in the site where they are not present. They also note that trying to engage the learners with novel strategies is challenging across sites, which limits their motivation to be innovative.

Lastly, teachers have evolving **relationships with the technology** and this requires a significant amount of articulation work. Teachers and technology work interactively to deliver the educational content to learners; yet, for many teachers, managing the technology adds another factor to manage in their teaching. Becoming comfortable with the technology is a process, and teachers who may provide only one or two sessions annually may experience it as stressful each time.

Discussion

Distributed medical education (DME) requires assemblages of people and things, including a variety of skilled workers who interact with material entities like curriculum and technology. Much of their work falls into the category of articulation work—work that is difficult to predict and plan as it involves helping to get things ‘back on track’ when there are unexpected occurrences, disruptions or challenges.

Given the advancement of videoconferencing technologies and the need to increase access to medical education opportunities for those in rural or underserved settings, it is likely that distributed approaches will continue to develop and evolve. It is important therefore that we explore work that has previously been deeply embedded and therefore invisible with a goal of making explicit the multiple social and material layers of DME, and understanding the roles of workers and materials within its delivery.

In shining a light on the articulation work associated with DME visible, we hope not only to make visible the sociomaterial complexities of DME, but also help to make this work more valued. Yet we recognize that in so doing, we are also exposing previously unexplored practices and drawing our lens to what Goffman (1969) termed “the back stage.” This might lead to opening up these practices to a more critical eye, and by extension to other consequences, including increased surveillance (Wagner, 1995). Nonetheless, we believe that it is important to acknowledge background work in order to recognize the hidden and undervalued skills of routine DME work, and, as Chambliss (1988) described, to understand as “the mundanity of excellence.”

Chambliss was referring to Olympic caliber athletes when he used the term ‘excellence,’ defining it as “consistent superior performance” (p. 8). Based on our ethnographic work; however, we noted a striking commitment and consistent

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displays of innovation by the workers who contribute to DME, and we feel it is fair to describe their work as a pursuit of excellence. In the context of DME, excellence is related to a number of factors, including the delivery of a seamless educational experience, the provision of a comparable educational experience across a variety of sites, and the ability to engage all learners, especially those who are physically removed.

The mundanity of the tasks involved in producing DME however, means that the quest for excellence by these workers remains largely invisible. Our data demonstrate that workers involved in DME engage regularly in articulation work, and for the most part, this type of work is under-recognized and undervalued. We are not advocating simply for “more visibility” as we recognize that there is a certain amount of power and autonomy associated with having the freedom to troubleshoot, make decisions and operate ‘below the radar.’ Yet, like Star and Strauss (1999) we also realize that there are examples of ‘good invisibility’ and ‘bad invisibility.’ Our goal in calling attention to this work is simply to explore the social and material assemblages required to produce DME and cast a new gaze on the unrecognized aspects of this educational approach.

Our feeling is that the relationship between visible and invisible work is complex and relational. With every effort to illuminate the complexity of DME, we potentially risk stifling the autonomy and creativity that was so apparent with respect to how these workers engaged in and delivered DME. While the goal of this paper is to

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increase awareness of the skill sets and work involved in a DME program, we recognize that there are trade-offs and balances involved. As Star and Strauss noted, “If the system does not account for the matrix of visible and invisible work and its questions of equity, those at the bottom will suffer.” (p. 25)

With that in mind, we suggest the following considerations for acknowledging and valuing the various types of work that are involved in facilitating DME, while maintaining a position at which workers are able to troubleshoot, improvise, and flourish in their roles:

1. Remember that technologies are maintained and monitored by people.
2. Recall that for some, doing a job requires a degree of invisibility, yet this does not preclude a desire for human interaction.
3. Recognize that policies and rules ‘come from somewhere’ and are often related to facilitating invisible work.
4. Remember that building relationships and social connections is an essential, and in some instances, emotionally complex aspect of some DME work.
5. Recognize that the integration of new technologies changes taken-for-granted ideas about our roles, and this can be intimidating and unsettling.

Conclusion

By focusing on the work of AV professionals, administrative professionals and faculty teachers, we have attempted to take an innovative look at some of the less

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obvious practices required to produce distributed medical education (DME). This has produced an unexpected account of the complexity of DME, shifting the gaze away from student experiences with a goal of helping to make clear the variety of work involved in delivering a distributed program. Beyond being sensitive to visible and invisible work and the relationships between people and things, it is our hope that the paper might begin a dialogue addressing the real-life complexity of technologically facilitated DME, and the multiple skill sets and expertise involved in its design and delivery.

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